

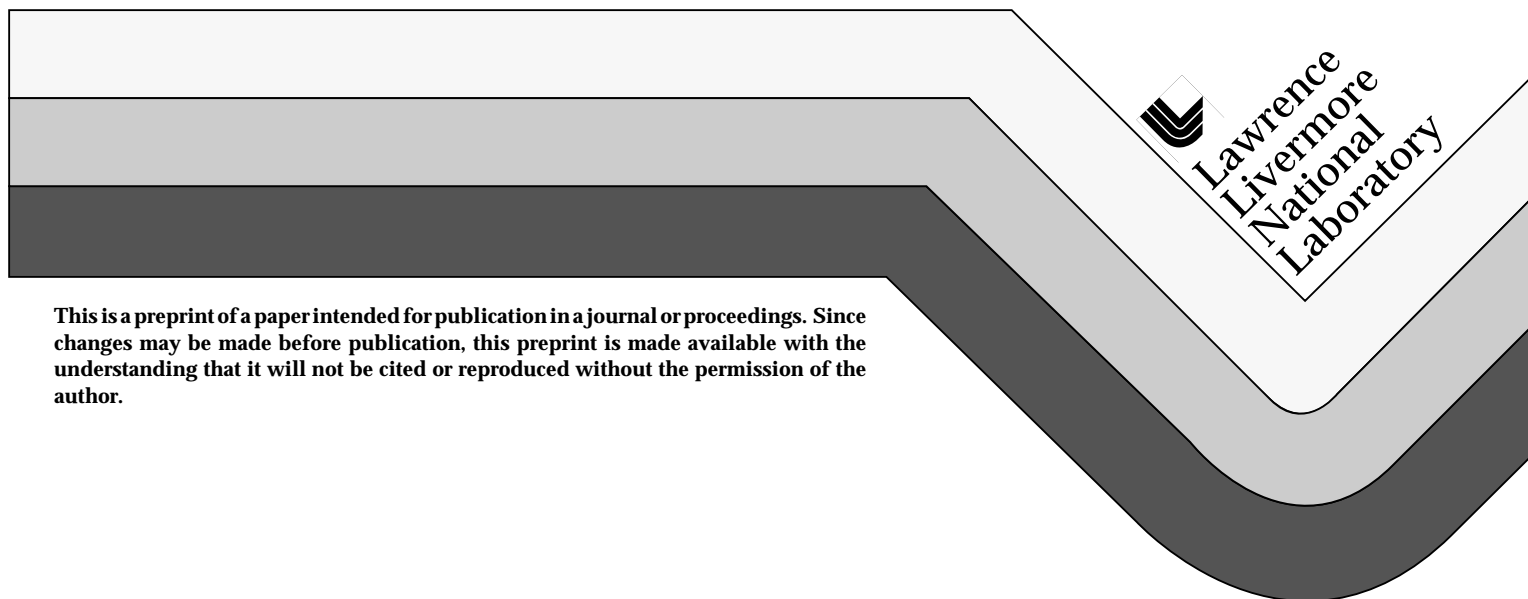
**Portable Radiological  
Instrumentation Survey  
for the  
Department of Energy**

**Radiological Instrumentation  
Standardization and Qualification Program**

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# Survey of Portable Radiological Instrumentation at 16 DOE Sites

## Abstract

The DOE-DP complex initiated a Radiological Instrument Standardization and Qualification Program to ensure the quality of radiological measurements within each DOE site. As part of the program, a complex-wide survey was conducted of all portable instruments in use at 16 DOE facilities. This paper presents the data gathered and suggests several possible standardization options.

## Introduction

Federal regulation (10 CFR 835) and DOE orders (Order 5480.11 [1988]) have established radiation protection standards, limits, and program requirements to protect individuals from ionizing radiation resulting from DOE activities. These regulation and orders also mandate testing, calibration, and documentation of all radiological instruments used at DOE facilities to ensure that such instruments produce credible readings in the field. Because of the large and diverse number of instruments within the DOE complex, compliance with these requirements require a significant effort. For the most part, testing and calibration procedures are responsibilities of the user facility.

The health physics community has developed standards for uniform instrument testing and calibration procedures. These standards primarily consists of information from ANSI 42.17A (Performance specifications for health physics instrumentation—portable instrumentation for use in normal environmental conditions) and ANSI 323 (Radiation protection instrumentation test and calibration). Federal regulations and DOE orders require a formal implementation program that encourages compliance with these standards. In addition, the *Radiological Control Manual* (DOE-N-5480.6, Chapter 5, Part 6) strongly encourages standardization of radiological instruments in the DOE community and the utilization of commercially available hardware wherever possible.

## Situation Assessment

An ongoing program has been established to evaluate, test, and qualify each type of portable radiological instrument within the DOE complex. As a preliminary step, a review of all radiological monitoring instruments was initiated in late 1994. The initial phase of this review focused on gathering information on various types and the number of instruments used in each DOE facility.

To expedite the collection of data, a 12-page survey was devised. This survey listed 264 of the most commonly used portable instrument types based on data obtained from the catalogues of six manufacturers. These instrument types included individual detectors and probes, as well as separate rate meters and integrated instruments. Instrumentation representatives from 16 of 21 DOE sites targeted to complete the survey provided input (see Table 1). A database was then developed integrating the data sets received to show the distribution of portable instruments within those sites. The information in the database will be used to assess the status and credibility of a DOE radiological instrumentation standardization and qualification program.

**Table 1. DOE Sites contacted for instrumentation survey.**

|   |  |
|---|--|
| <b>Argonne National Laboratory</b><br><b>Argonne, IL 60439</b>  | <b>Battelle Pacific Northwest, 16*</b><br><b>Richland, WA 99352</b><br><b>Tom Froelich</b>                           |
| <b>Brookhaven National Laboratory, 15*</b><br><b>Upton, NY</b><br><b>Paul Tahra</b>                           | <b>EG&amp;G Rocky Flats Plant, 5*</b><br><b>Golden, CO 80402-0464</b><br><b>Bob Kennard</b>                          |
| <b>EG&amp;G Mound Applied Technologies, 12*</b><br><b>Miamisburg, OH 45343-3000</b><br><b>Stephen Hoadley</b> | <b>FERMCO Fluor Daniels Fernald Facility, 6*</b><br><b>Cincinnati, OH 45239-8704</b><br><b>Craig Fletcher</b>        |
| <b>Fermi National Accelerator Laboratory</b><br><b>Batavia, IL 60510</b>                                      | <b>Idaho National Engineering</b><br><b>Laboratory, 13*</b><br><b>Idaho Falls, ID 83415</b><br><b>Gary Labruyere</b> |
| <b>Lawrence Berkeley Laboratory</b><br><b>Berkeley, CA 94720</b>  | <b>Lawrence Livermore National</b><br><b>Laboratory, 9*</b><br><b>Livermore, CA 94550</b><br><b>Dave Trombino</b>    |
| <b>Los Alamos National Laboratory, 14*</b><br><b>Los Alamos, NM 87545</b><br><b>William Martinez</b>          | <b>Martin Marietta Utility Systems</b><br><b>Piketon, OH 45661</b>   |
| <b>Martin Marietta Utility Systems, 7*</b><br><b>Paducah, KY 42001</b><br><b>James Sheppard</b>               | <b>Martin Marietta Utility Systems, 8*</b><br><b>Portsmouth, OH</b><br><b>Stan Jones</b>                             |
| <b>Mason &amp; Hanger/Pantex Plant, 11*</b><br><b>Amarillo, TX 79177</b><br><b>Danny Wilhelm</b>              | <b>Oak Ridge National Laboratory, 2*</b><br><b>Oak Ridge, TN 37831-6375</b><br><b>Peter Chiaro Jr.</b>               |
| <b>Rust Geotech, 1*</b><br><b>Grand Junction, CO 81502</b><br><b>Nathan Key</b>                               | <b>Sandia National Laboratories, 3*</b><br><b>Albuquerque, NM 87185</b><br><b>David Sinton</b>                       |
| <b>Sandia National Laboratories</b><br><b>Livermore, CA 94550</b>   | <b>Savannah River Site, 4*</b><br><b>Aiken, SC 29808</b><br><b>Bill Willie</b>                                       |
| <b>Nevada Test Site-RECO, 10*</b><br><b>Mercury, NV</b><br><b>Mable Belt</b>                                  |  |

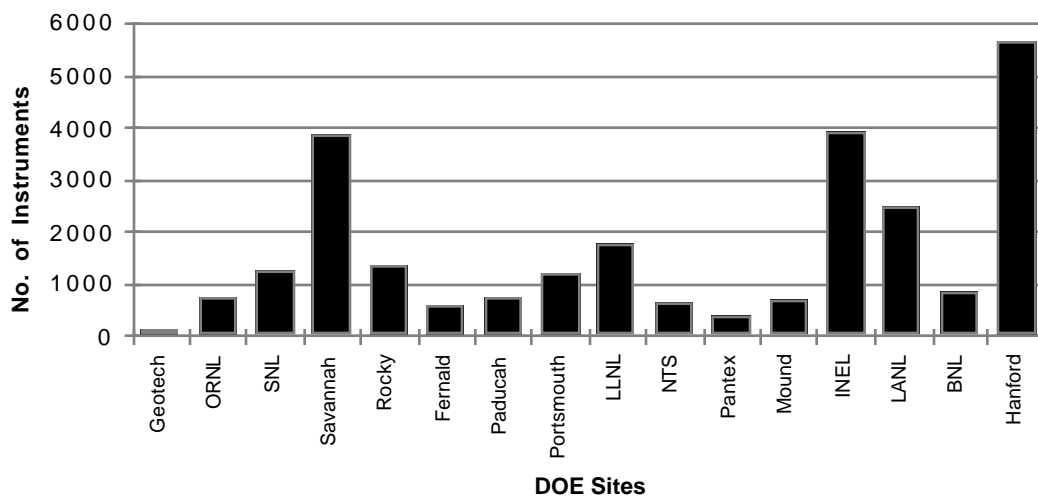
\* Indicates facilities that provided information for this survey. The number after the facility is the reference number used for that facility at the top of Appendix A.

## Survey Results

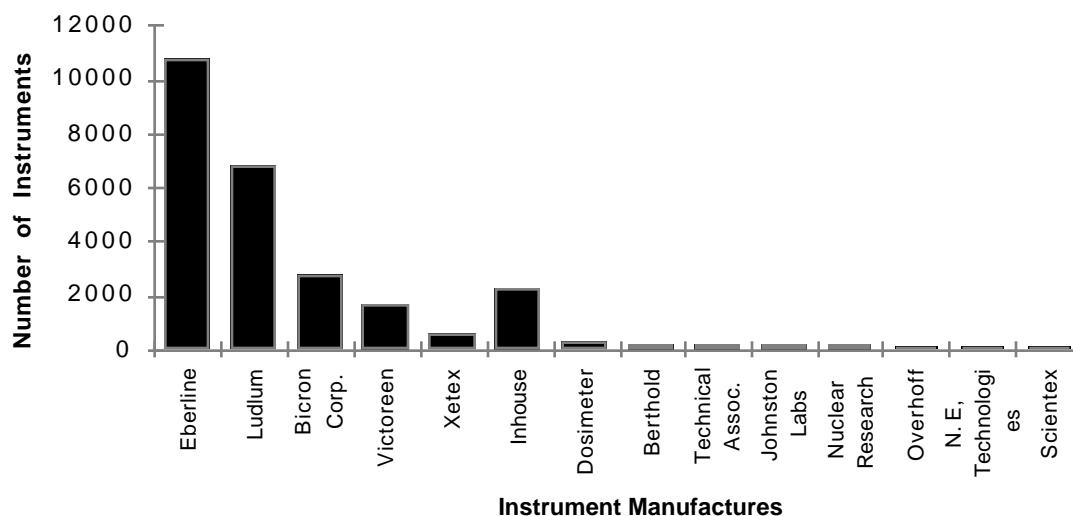
Data obtained from the survey were tabulated using a commercial spreadsheet software, a printout of which is shown in Appendix A. This software allowed for easy, structured expansion of the database as new information was received. Twenty-two manufacturers were added to the database, accounting for about 41 percent of the 53 portable instrument manufacturers listed in the *Nuclear News Buyers Guide*. Among these manufacturers, over 394 different instrument types were identified and subdivided into alpha/beta meters, rate meters, gamma meters, ion chamber instruments, neutron instruments, detectors and probes, integrated survey instruments, and other multipurpose units. In addition, 9 in-house model types were included in database. An estimated 26,309 units in use at the 16 DOE sites (or about 61 percent of the models listed on the survey) were catalogued into 241 instrument types. Seventy-two instruments for which there were no model types were not included as different models or in the total instrument count; these are listed at the end of Appendix A.

Figure 1 shows the site distribution of most of the 26,309 units. The number of instruments for each facility ranges from a low of 141 to a high of 5649. Figure 2 shows the distribution of instruments among 14 of 22 manufacturers most frequently used; data for the other 8 manufacturers were not included because they contributed less than 0.9 percent of the total instrument inventory. Tabulation of data from the survey also shows that 85 percent of the instruments used by DOE contractors is fabricated by 5 companies, and about 8 percent is designed in-house by two DOE facilities (LLNL and Hanford).

It is recommended in the U. S. Department of Energy *Implementation Guide* that representative performance testing be conducted for each radiological instrument model used in a DOE facility. It is encouraged that this testing be done in accordance with applicable sections of ANSI N42.17A and C. Tabulation of the different instrument model types used in DOE facilities is completed, facilitating a more prudent and cost-effective planning effort for a complex-wide testing program. However, information on the model types alone is insufficient. To plan testing priorities, the distribution of instruments among the model types is most helpful. The data provided by the 16 DOE facilities responding to the survey permit analysis of instrument standardization and qualification scenarios.



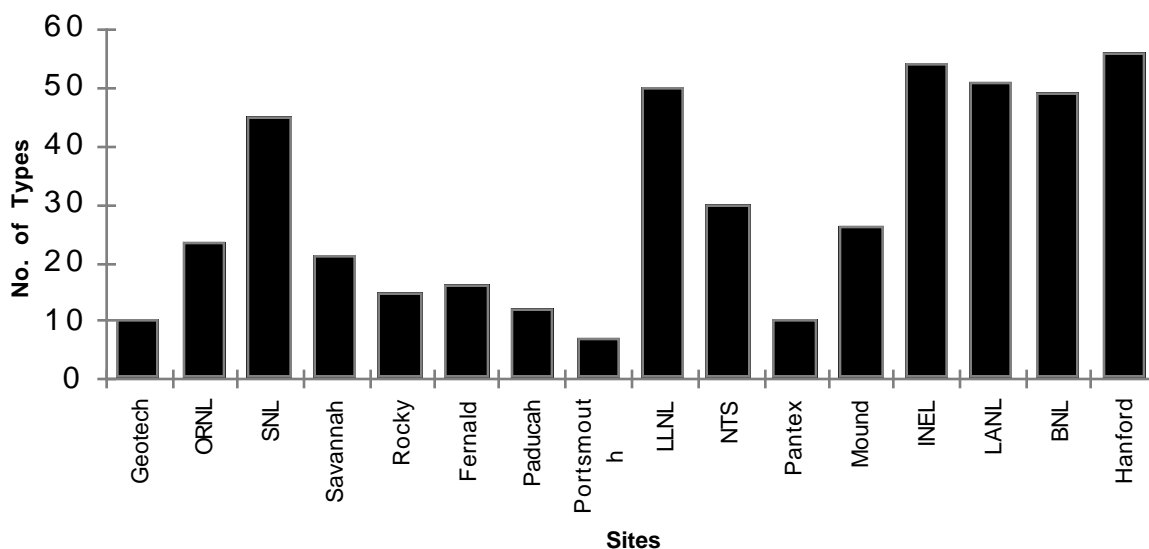
**Figure 1. Number of instruments at DOE sites.**



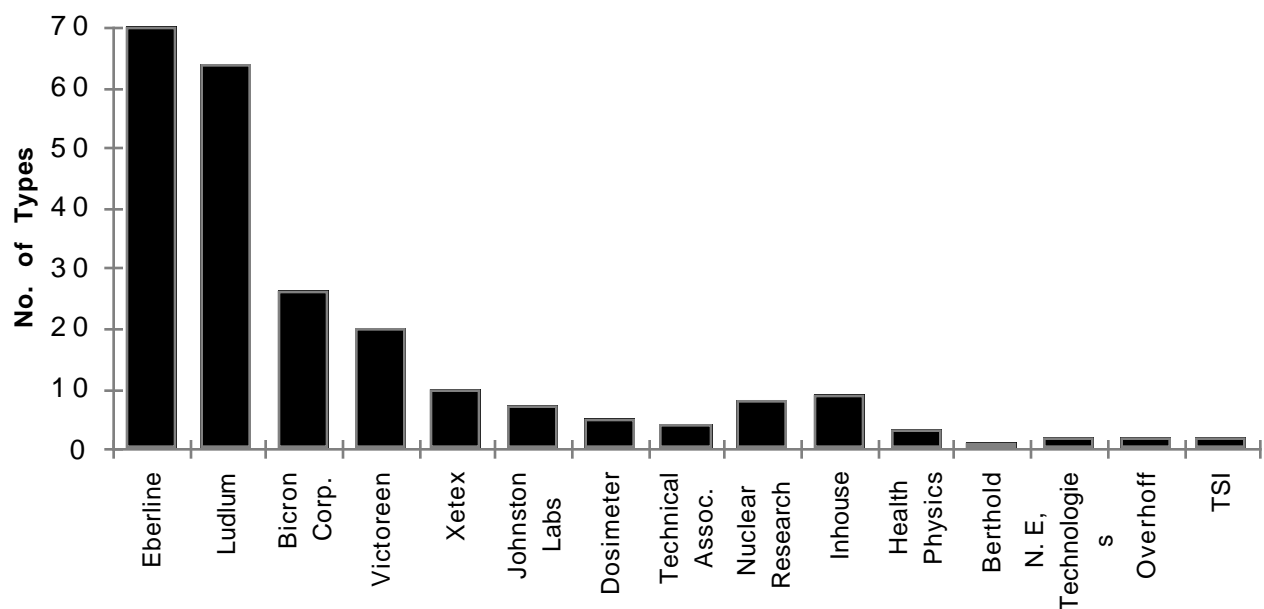
**Figure 2. Instrument totals by manufacturer.**

Appendix B lists all the models used within the defined DOE complex with a total population of 99 or greater. This tabulation is presented to show the 55 most popular model types. The number of units included within these 55 models is 21,626, or about 82 percent of the 26,309 instrument population.

Figure 3 shows a representative-type distribution among the 16 DOE sites. The number of instrument types used in each facility ranges from a high of 56 to a low of 7, with a total of 241 instrument types in use. Figure 4 shows the instrument types reported as a function of the manufacturer. About 88 percent of the model types are supplied by 9 instrument manufacturers, with about 74 percent (or 180 types) provided by only 4 suppliers.



**Figure 3. Number of instrument types at DOE sites.**



**Figure 4. Number of instrument types used.**

A significant number of portable instruments is used and serviced within the DOE complex. Data from 12 of 14 facilities responding to an informal inquiry regarding maintenance efforts and recordkeeping practices indicated that the repair/calibration volume ranged from a high of 1000 to a low of 35 instruments per month, and that recordkeeping on paper appeared to be adequate for low-volume facilities, while other facilities used special personal computer (PC) hardware and commercial database software.<sup>1</sup> Among these 12 facilities, at least 5 different database software programs were being used. The tabulation of instruments in use at a particular facility required personnel to write a FORTRAN code to retrieve data. This information suggests that standardization of keeping records on hardware and software would make it easier to exchange data and use common testing procedures.

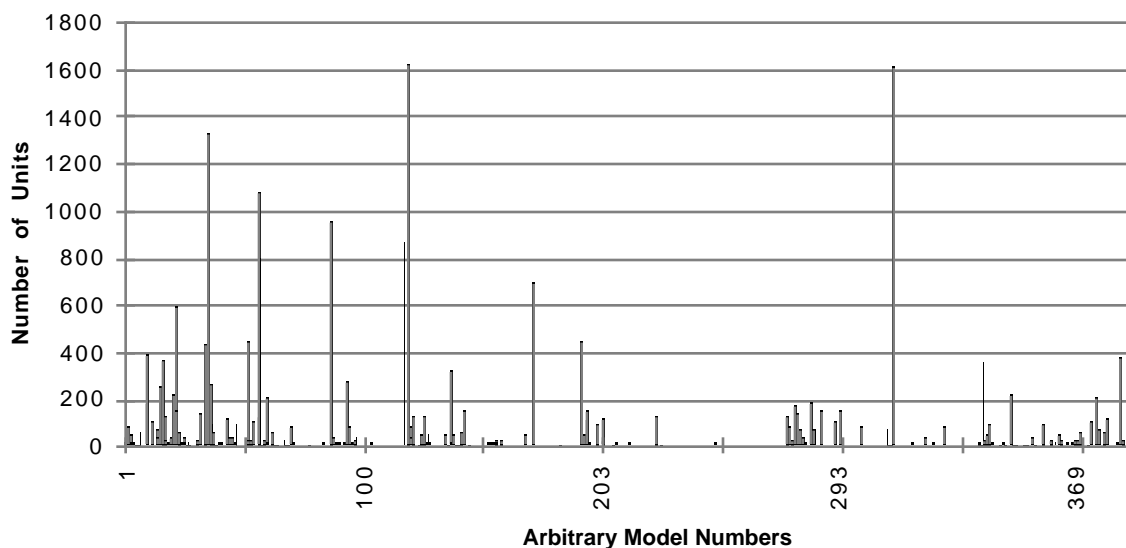
## Survey Implications

Newer regulations and guidelines encourage type testing the radiological instruments used in DOE facilities as a qualification requirement. Data from the survey can provide an indication of the cost associated with type testing. The cost estimate in a 1986 report (NUREG/CR—6062) is based on testing 16 factors of 5 individual instruments with the same model or type. This report suggests that full type testing for an “A” category unit (one tested against all factors outlined in ANSI 42.17) would require about \$22K (1986 dollars) per instrument type. Assuming an average inflation rate of 5 percent per year, this amount can be conservatively estimated to equal about \$34K (1995 dollars). If all 241 instrument types used by DOE contractors were to be type tested for regulatory compliance, the cost to DOE would be about \$8.2M. This does not include the cost of testing new models or replacing older ones. Thus, it is not prudent to blindly test all the instrument types listed in this report. Instead, reasonable instrument standardization should be investigated to determine if the cost of testing can be reduced by eliminating less popular instrument types. Further analysis of instrument-type population numbers shows that some *de facto* standardization is already taking place.

Figure 5 shows some significant peaks when the number of units is plotted against the model number. The height of these peaks represents the total number of units in use for a particular model type. If the standard instrument set is defined to be only those models where the number in use is above an arbitrary “inclusion threshold,” then the number of type tests required for compliance can be reduced. Table 2 shows that as the inclusion threshold increases, the number of model types and instrument numbers decreases. A closer look at the data shows that the instrument types drop faster than the total number of instruments included in the types above a threshold.

If one generates a standard set from all instrument types with a population of 50 or above, then the model types can be reduced to 87 (or about 36 percent of the 241 types). With this decrease, over 90 percent of the original instruments can still be retained. In addition, the type-testing cost would decrease significantly and replacement costs would only be about 10 percent of the total instrument set cost. However, the real cost of standardizing at an inclusion threshold suggests that there is a need to include the instrument replacement cost. With an increasing model inclusion threshold, the type-testing cost would decrease but the replacement cost for eliminated model units would increase. There is also an optimum threshold that is dependent on replacement model costs. For example, if an average instrument cost of \$400 per unit is assumed, then the cost of replacing 10 percent of the base set (2,631 instruments) would be about \$1M. Thus, the cost to settle on a threshold of 50 would be about \$4M. This is about \$4.2M less than type testing all 241 instrument types. Clearly, the move to reduce model types can have significant program cost benefits.

If one considers just those models for which the total number in use is greater than 200, then only 30 models need to be tested for full compliance. The actual number requiring testing will be slightly higher since it is important not to exclude special instruments with low populations like neutron detectors. In any case, this type selection will permit 18,425 instruments to be type tested at a cost of only \$1,020,000. If replacement costs were ignored, this would be an approximately \$7M saving. In this scenario, the savings estimates would be further reduced if all excluded model types were replaced with permitted model types. Furthermore, if we assume an average instrument cost of \$400 per unit, then the replacement cost would be about \$3.1M—resulting in a savings of about \$4.1M. This savings is about the same as that previously estimated. Like the first option, this plan would also require a continuous testing program for new models as they replace older units used within the DOE complex. However, a more detailed study should be conducted before taking any specific actions.



**Figure 5. Total instruments vs. models.**



**Table 2. Type and number of distribution with estimated type-testing cost.**

| <b>Inclusion threshold</b> | <b>Number of units</b> | <b>Number of types</b> | <b>No. (%)</b> | <b>Types (%)</b> | <b>Testing cost per unit (\$)</b> | <b>Total type-testing cost (\$)</b> |
|----------------------------|------------------------|------------------------|----------------|------------------|-----------------------------------|-------------------------------------|
| <b>1</b>                   | <b>26309</b>           | <b>241</b>             | <b>100</b>     | <b>100</b>       | <b>34,000</b>                     | <b>8,194,000</b>                    |
| <b>25</b>                  | <b>23921</b>           | <b>122</b>             | <b>90.9</b>    | <b>49.2</b>      | —                                 | <b>4,148,000</b>                    |
| <b>50</b>                  | <b>23921</b>           | <b>87</b>              | <b>90.9</b>    | <b>35.1</b>      | —                                 | <b>2,958,000</b>                    |
| <b>100</b>                 | <b>21743</b>           | <b>52</b>              | <b>82.6</b>    | <b>21</b>        | —                                 | <b>1,768,000</b>                    |
| <b>150</b>                 | <b>19434</b>           | <b>36</b>              | <b>73.9</b>    | <b>14.5</b>      | —                                 | <b>1,224,000</b>                    |
| <b>200</b>                 | <b>18425</b>           | <b>30</b>              | <b>70</b>      | <b>12.1</b>      | —                                 | <b>1,020,000</b>                    |
| <b>250</b>                 | <b>16902</b>           | <b>23</b>              | <b>64.2</b>    | <b>9.27</b>      | —                                 | <b>782,000</b>                      |

Idaho National Engineering Laboratory and former EG&G sites have proposed adoption and procurement of a standard set of less than 10 instruments. This proposal has merit, but a rigid centralized procurement scheme may or may not be suitable. For example, special needs at each DOE site may be different thus requiring different instruments, and a closed centralized system may be too inflexible. This proposed standard instrument set should be compared to instruments currently in use to determine if there are any deficiencies, and the potential cost of replacing old instruments with new ones should be considered. Factors concerning special calibration procedures and equipment, spare parts, maintenance and user training, and documentation requirements should also be considered. This option may be less costly than the previous in the long term, but a close evaluation is necessary to access the cost impact of such a significant change.

Another way of reducing program enhancement costs is to share testing and maintenance data and procedures that already exists. (Existing data may show that some instruments have already been sufficiently tested.) This is done by using an on-line computer database network, INTERNET, accessible to all DOE contractors. At present, the database information is on-line and available. A straw-man proposal regarding the nature and information in this database has been generated and presented for open discussion among potential users. The use of a shared database appears to be the one option most preferred by the DOE site representatives who participated in the survey.

## **Conclusions**

From the data reviewed, it is clear that a well-structured standardization and qualification program is required to maintain the many diverse types of radiological instruments within the DOE complex. This program would allow for instrument standardization, evaluation, upgrade, and the sharing of information among DOE facilities to ensure consistency with institutional requirements. Implementation of the program would require more detailed data in order to assess the current status of instruments with the DOE complex. A technically viable plan can result in substantial costs savings.

## **References**

1. Data from informal survey provided by Don Gregory of Oak Ridge National Laboratory.

## **Acknowledgments**

A special thank to the individuals who provided input for this report. Without your cooperation we could not have conducted the survey.

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## **Appendix A**

### **Distribution of Portable Radiological Instruments and Types Among 16 DOE Sites**

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| Portable Radiological Survey Data    |  |                                   |                |                |                 |                |                |                     |          |            |         |              |        |                   |                     |     |              |
|--------------------------------------|--|-----------------------------------|----------------|----------------|-----------------|----------------|----------------|---------------------|----------|------------|---------|--------------|--------|-------------------|---------------------|-----|--------------|
|                                      | 1  | 2                                 | 3              | 4              | 5               | 6              | 7              | 8                   | 9        | 10         | 11      | 12           | 13     | 14                | 15                  | 16  | Totals       |
| USER FACILITY                        | GIPO En                                    | Oak Ridge                         | Sandia N.      | Savanna        | Rocky F         | FERMCO         | Paducah        | Portsmc             | Lawrenci | Nevada     | Pantex  | I Mound      | INEL   | Los Alar          | Brookha             | PNL | Hanford Site |
| CONTACT                              | Nathan K                                   | Peter Ch                          | David Sir      | Bill Wil       | Bob Ken         | Craig F        | James S        | Stan Jor            | Dave Tr  | Mable B    | Danny V | Stephen Gary | Lal    | William Paul      | Tat                 | Tom | Froelich     |
| PHONE                                | "303 248 615-576                           | 505-844 803-721                   | 303-961513-731 | 502-441614-891 | 510-421702-291  | 806-471513-861 | 208-521505-661 | 516-281509-376      | 7466     |            |         |              |        |                   |                     |     |              |
| FAX #                                | 330 248 615-574                            | 505-844 803-725-3272              | 513-731502-441 | 614-891510-421 | Na              | 806-471513-861 | 208-521505-661 | 516-281509-376-2498 |          |            |         |              |        |                   |                     |     |              |
| Address                              | P.O. Box 2597 B3/ Ms                       | P.O. Box 6042, M. S. 109          | Westingh       | E G & G Flor   | Dar             | Martin I       | Martin I       | Univ. of REECO/I    | Mason&   | E G & G    |         |              |        | Univ. of Budg. 12 | P.O. Box 999, P7-01 |     |              |
| Portable Survey meters in use (only) | Grand Ju                                   | Bldg 200                          | Albuquerque    | Aiken, S       | Golden, 45239-1 | Paducah        | Piketon        | (Livermor           | Las Veg  | 79177      | Miamisb | Idaho F      | MS 444 | 11973             | 99352               |     |              |
| Manufacture:                         | 81502                                      | Oak Ridg                          | NM. 87185-1095 |                |                 |                | 42001          | 45661               | 94550    | 89193-8521 |         | 45343-1      | 83404  | Los Alamos, NM    | 87544               |     |              |
| EBERLINE-----                        |  |                                   |                |                |                 |                |                |                     |          |            |         |              |        |                   |                     |     |              |
| Model                                | Description                                | Quantity IN USE<br>(Approximate ) |                |                |                 |                |                |                     |          |            |         |              |        |                   |                     |     |              |
| Alpha/Beta                           |  |                                   |                |                |                 |                |                |                     |          |            |         |              |        |                   |                     |     |              |
| PAC- 1SAGA                           | Portable Alpha-Gamma Scintillation Counter |                                   |                |                |                 |                |                |                     |          |            |         |              |        |                   |                     |     |              |
| PAC-4G-3                             | Gas Proportional Survey Meter              |                                   |                |                |                 |                |                |                     |          |            |         |              |        |                   |                     |     |              |
| PAC-4S                               | Survey Meter                               |                                   |                |                |                 |                |                |                     |          |            |         |              |        |                   |                     |     |              |
| SAC-4                                | Portable Alpha Scintillation Cc            | 10                                |                |                |                 |                |                |                     |          |            |         |              |        |                   |                     |     |              |
| BC-4                                 | Beta Counter                               | 10                                |                |                |                 |                |                |                     |          |            |         |              |        |                   |                     |     |              |
| AMS-3                                | Beta Air monitor                           | 2                                 |                |                |                 |                |                |                     |          |            |         |              |        |                   |                     |     |              |
| Alpha 5                              | Alpha Air Monitor                          | 4                                 |                |                |                 |                |                |                     |          |            |         |              |        |                   |                     |     |              |
| Alpha 6                              | Alpha Air Monitor                          | 4                                 |                |                |                 |                |                |                     |          |            |         |              |        |                   |                     |     |              |
| R0-25-2A                             | High Range Alpha Meter                     | 58                                |                |                |                 |                |                |                     |          |            |         |              |        |                   |                     |     |              |
| Rate Meters                          |  |                                   |                |                |                 |                |                |                     |          |            |         |              |        |                   |                     |     |              |
| ASP-1                                | Analog Smart Portable                      | 120                               |                |                |                 |                |                |                     |          |            |         |              |        |                   |                     |     |              |
| E-120/E-120E                         | Beta-Gamma Count Rate Meter                |                                   |                |                |                 |                |                |                     |          |            |         |              |        |                   |                     |     |              |
| E-130                                | Beta-Gamma Count Rate Meter                |                                   |                |                |                 |                |                |                     |          |            |         |              |        |                   |                     |     |              |
| E-140                                | Beta-Gamma Count Rate Meter                |                                   |                |                |                 |                |                |                     |          |            |         |              |        |                   |                     |     |              |
| E-140N                               | Beta-Gamma Count Rate Meter                |                                   |                |                |                 |                |                |                     |          |            |         |              |        |                   |                     |     |              |
| E-520                                | Beta-Gamma Count Rat                       | 1                                 | 30             |                |                 |                |                |                     |          |            |         |              |        |                   |                     |     |              |
| E-530                                | Beta-Gamma Count Rate Meter                |                                   |                |                |                 |                |                |                     |          |            |         |              |        |                   |                     |     |              |
| ESP-1                                | Eberline Smart Portable                    | 16                                | 2              | 1              | 10              |                |                |                     |          |            |         |              |        |                   |                     |     |              |
| ESP-2                                | Eberline Smart Portable                    | 2                                 | 2              | 60             | 3               |                |                |                     |          |            |         |              |        |                   |                     |     |              |
| SRM-100                              | Smart Radiation Monitor                    | 1                                 |                |                |                 |                |                |                     |          |            |         |              |        |                   |                     |     |              |
| SRM-200                              | Smart Radiation Monitor                    | 15                                |                |                |                 |                |                |                     |          |            |         |              |        |                   |                     |     |              |
| SRM-300                              | Smart Radiation Monitor                    |                                   |                |                |                 |                |                |                     |          |            |         |              |        |                   |                     |     |              |
| PRS-1or 1P                           | Ratemeter/ Scaler                          | 9                                 |                |                |                 |                |                |                     |          |            |         |              |        |                   |                     |     |              |
| RM14SA                               | Bench top Ratemeter                        | 30                                |                |                |                 |                |                |                     |          |            |         |              |        |                   |                     |     |              |
| RM12 w/43-5                          | Bench top Ratemeter w Det.                 |                                   |                |                |                 |                |                |                     |          |            |         |              |        |                   |                     |     |              |
| RM12 w/44-9                          | Bench top Ratemeter w Det.                 |                                   |                |                |                 |                |                |                     |          |            |         |              |        |                   |                     |     |              |
| RM14                                 |  |                                   |                |                |                 |                |                |                     |          |            |         |              |        |                   |                     |     |              |
| RM14S                                |  |                                   |                |                |                 |                |                |                     |          |            |         |              |        |                   |                     |     |              |
| RM19                                 |  |                                   |                |                |                 |                |                |                     |          |            |         |              |        |                   |                     |     |              |
| RM20                                 | Bench top Ratemeter                        | 20                                |                |                |                 |                |                |                     |          |            |         |              |        |                   |                     |     |              |
| PRM-5                                |  |                                   |                |                |                 |                |                |                     |          |            |         |              |        |                   |                     |     |              |
| PRM-53                               |  |                                   |                |                |                 |                |                |                     |          |            |         |              |        |                   |                     |     |              |
| PRM-6                                |  |                                   |                |                |                 |                |                |                     |          |            |         |              |        |                   |                     |     |              |
| PRM-7                                |  |                                   |                |                |                 |                |                |                     |          |            |         |              |        |                   |                     |     |              |
| Gamma                                |  |                                   |                |                |                 |                |                |                     |          |            |         |              |        |                   |                     |     |              |
| ASP-1/SPA-8                          | Micro "R" Meter                            |                                   |                |                |                 |                |                |                     |          |            |         |              |        |                   |                     |     |              |

JC-118903 App A

|                          |                                   |                 |     |     |      |    |    |    |     |     |     |     |     |      |      |      |      |       |
|--------------------------|-----------------------------------|-----------------|-----|-----|------|----|----|----|-----|-----|-----|-----|-----|------|------|------|------|-------|
| E-130A                   | Gamma Survey Meter (Radiographic) |                 |     |     |      |    |    |    |     |     |     |     |     |      |      |      | 21   | 21    |
| 6112B/6150AD             | Teletectors                       | 6               |     | 56  | 12   | 6  | 10 | 6  | 1   | 2   |     | 23  | 11  | 12   | 1    | 146  |      |       |
| Ion Chambers             |                                   |                 |     |     |      |    |    |    |     |     |     |     |     |      |      |      |      | 0     |
| PIC-6A orB               | Portable Ion Chamber              |                 | 40  |     |      |    |    |    | 26  | 125 |     | 111 | 128 | 10   |      | 440  |      |       |
| RO-2/2A/20               | Ion Chamber (Juno Type)           | 16              |     | 853 | 25   |    |    | 36 | 66  |     | 21  | 220 | 90  | 55   | 29   | 1411 |      |       |
| RO-3C/3D                 | Ion Chamber (Cutie Pie Type)      |                 | 35  |     |      | 38 |    |    |     | 21  |     | 70  | 91  |      | 512  | 767  |      |       |
| RO-7                     | Ion Chamber (High Range)          |                 |     | 63  |      |    |    |    | 4   |     |     | 20  | 3   | 4    | 30   | 124  |      |       |
| RO-7 BH                  | Ion Chamber (High Range)          |                 |     | 27  |      |    |    |    |     |     |     |     |     |      |      | 27   |      |       |
| RO-7 BM                  | Ion Chamber (Mid Range)           |                 |     | 55  |      |    |    |    |     |     |     |     |     |      |      | 55   |      |       |
| RO-7 LD                  | Ion Chamber (Low Range)           |                 |     | 4   |      |    |    |    |     |     |     |     |     |      |      | 4    |      |       |
| RO-20                    |                                   |                 |     |     |      | 10 |    |    |     |     |     |     |     |      |      | 10   |      |       |
| Monitor 1                | GM survey meter                   |                 |     |     |      |    |    |    |     |     |     |     | 8   |      |      | 8    |      |       |
| Neutron                  |                                   |                 |     |     |      |    |    |    |     |     |     |     |     |      |      |      |      | 0     |
| ASP-1 /NRD               | Portable Neutron rem Counter      |                 | 15  | 101 |      |    |    |    |     |     |     |     |     | 4    |      | 120  |      |       |
| ESP-1 /NRD               | Portable Neutron rem Counter      |                 |     |     | 10   |    |    |    |     | 1   |     |     |     |      |      | 11   |      |       |
| ESP-2/NRD                | Portable Neutron rem Counter      |                 | 10  |     |      |    |    |    |     | 5   |     |     | 21  | 2    |      | 38   |      |       |
| RM-16                    | Neutron Rem meter                 |                 | 15  |     |      |    |    |    |     |     |     |     | 22  |      |      | 37   |      |       |
| PNR-4                    | Neutron Rem meter                 |                 | 1   |     |      |    |    |    | 1   | 10  |     |     |     |      |      | 12   |      |       |
| PNR-4/NRD                | Neutron Rem counter               |                 |     | 6   |      |    |    |    |     |     |     | 36  | 57  |      |      | 99   |      |       |
| EBERLINE-----            |                                   |                 |     |     |      |    |    |    |     |     |     |     |     |      |      |      |      | 0     |
| Model                    | Description                       | Quantity IN USE |     |     |      |    |    |    |     |     |     |     |     |      |      |      | 0    |       |
|                          |                                   | (Approximate )  |     |     |      |    |    |    |     |     |     |     |     |      |      |      | 0    |       |
| Detectors & Probes       |                                   |                 |     |     |      |    |    |    |     |     |     |     |     |      |      |      |      | 0     |
| AC-3                     | Alpha Scintillation Probe         |                 | 75  |     |      |    |    |    |     | 4   |     | 200 | 120 | 41   | 10   | 450  |      |       |
| HP-IOOA/AGS              | Hand Probe                        |                 | 1   |     |      |    |    |    |     |     |     |     | 20  |      | 3    | 24   |      |       |
| HP-IOOB/BGS              | Hand Probe                        |                 |     |     |      |    |    |    |     |     |     |     | 20  |      |      | 20   |      |       |
| HP-I90A                  | Hand Probe                        | 100             |     |     |      |    |    |    |     |     |     |     |     |      |      | 100  |      |       |
| HP-220A                  | Hand Probe                        |                 |     |     |      |    |    |    |     |     |     |     |     |      |      | 0    |      |       |
| HP-210T/AL/L             | Hand Probe                        |                 | 15  |     |      |    |    |    |     |     |     | 100 | 10  |      | 83   | 208  |      |       |
| HP-260                   | G M Hand Probe                    |                 | 115 |     |      |    |    |    |     |     |     | 700 | 260 |      | 800  | 1875 |      |       |
| HP-270/90                | Hand Probe                        |                 | 170 |     |      |    |    |    |     |     |     | 500 | 114 |      | 2    | 786  |      |       |
| HP-280                   | Hand Probe                        |                 |     |     |      |    |    |    |     |     |     |     | 2   |      |      | 2    |      |       |
| LEG-1                    | Low Energy Gamma Pro              | 1               |     |     |      |    |    |    |     |     |     | 10  | 10  | 2    | 5    | 28   |      |       |
| NRD                      | Neutron Detector                  | 4               | 40  |     | 10   |    |    |    |     | 2   | 10  | 45  | 96  | 8    |      | 215  |      |       |
| PG-2                     | Low Energy Gamma Pro              | 1               |     |     |      |    |    |    |     |     |     | 5   | 10  | 1    |      | 17   |      |       |
| SPA-1A                   | Alpha Scintillation Probe         |                 |     |     |      |    |    |    |     |     |     |     |     |      | 1    | 1    |      |       |
| SPA-3                    | Gamma Scintillation P             | 25              | 4   |     |      |    |    |    |     |     |     | 5   | 15  |      | 2    | 51   |      |       |
| SPA-6                    | Gamma Scintillation Probe         |                 |     |     |      |    |    |    |     |     |     |     | 2   |      |      | 2    |      |       |
| SPA-8                    | Scintillation Probe               |                 |     |     |      |    |    |    |     |     |     |     | 2   |      | 3    | 5    |      |       |
| SPA-9                    | Scintillation Probe               |                 |     |     |      |    |    |    |     |     |     |     | 2   |      | 1    | 3    |      |       |
| Other Multipurpose Units |                                   |                 |     |     |      |    |    |    |     |     |     |     |     |      |      |      |      | 0     |
| PCM-1                    | Personnel Contamination mon       | 18              |     |     |      |    |    |    |     |     |     |     |     |      |      | 18   |      |       |
| PCM-2                    | Personnel Contamination mon       | 1               |     |     |      |    |    |    |     |     |     |     |     |      |      | 1    |      |       |
| MS1                      |                                   |                 |     |     |      |    |    |    | 3   |     |     |     |     |      |      | 3    |      |       |
| MS2                      |                                   |                 |     |     |      |    |    |    | 4   |     |     |     |     |      |      | 4    |      |       |
| Rad Tad                  | Gamma chirper                     |                 |     |     |      |    |    |    |     |     |     |     | 78  |      |      | 78   |      |       |
| RT1A                     |                                   |                 |     |     |      |    |    |    |     |     |     |     |     |      |      |      |      | 0     |
| EBERLINE                 | SUBTOTAL-----                     | 75              | 157 | 814 | 1227 | 67 | 59 | 10 | 948 | 675 | 283 | 5   | 373 | 2397 | 1497 | 157  | 1986 | 10730 |

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|                    |   |                 |     |   |     |     |    |   |   |     |    |    |    |    |    |     |    |      |     |
|--------------------|---|-----------------|-----|---|-----|-----|----|---|---|-----|----|----|----|----|----|-----|----|------|-----|
| Manufacture:       |   |                 |     |   |     |     |    |   |   |     |    |    |    |    |    |     |    |      | 0   |
| VICTOREEN-----     |   |                 |     |   |     |     |    |   |   |     |    |    |    |    |    |     |    |      | 0   |
| Model              | Description                             | Quantity IN USE |     |   |     |     |    |   |   |     |    |    |    |    |    |     |    |      | 0   |
|                    |   | (Approximate )  |     |   |     |     |    |   |   |     |    |    |    |    |    |     |    |      | 0   |
| Rate Meters        |   |                 |     |   |     |     |    |   |   |     |    |    |    |    |    |     |    |      | 0   |
| 190                | Survey and Count Rate Meter             | 2               |     |   |     |     |    |   |   |     |    |    |    |    |    |     |    |      | 2   |
| 290                | Thyac IV Survey Meter                   | 1               |     |   |     |     |    |   |   |     |    |    |    |    |    |     |    |      | 1   |
| 400/400R           | NDT Survey Meter                        |                 |     |   |     |     |    |   |   |     |    |    |    |    |    |     |    |      | 0   |
| 410/410R           | GM Extended Range Survey Meter          |                 | 1   |   |     |     |    |   |   |     |    |    |    |    |    |     |    |      | 1   |
| 190F               | Frisker Survey Meter                    |                 |     |   |     |     |    |   |   |     |    |    |    |    |    |     |    |      | 0   |
| 478                | Snoopy Portable Neutron Monitor         |                 |     |   |     |     |    |   |   |     |    |    |    |    |    |     |    |      | 0   |
| 490                | Thyac III Survey Meter                  |                 |     |   |     |     |    |   |   |     |    |    |    |    |    |     |    |      | 0   |
| 491                | Wide Range GM Survey Meter              |                 |     |   |     |     |    |   |   |     |    | 8  |    |    |    |     |    | 8    |     |
| 492                | Radiographic Survey Meter               |                 |     |   |     |     |    |   |   |     |    |    |    |    |    |     |    |      | 0   |
| 493                | Utility Survey Meter                    |                 |     |   |     |     |    |   |   |     |    |    |    |    |    |     |    |      | 0   |
| 496                | Survey Meter                            | 957             |     |   |     |     |    |   |   |     |    |    |    |    |    |     |    |      | 957 |
| 497                |   |                 | 2   |   |     |     |    |   |   |     |    |    |    |    |    |     |    |      | 2   |
| 660-1              |   |                 | 8   |   |     |     |    |   |   |     |    |    |    |    |    |     |    |      | 8   |
| 808                | Portable Ram                            |                 |     |   |     |     |    |   |   |     |    |    | 30 |    |    |     | 30 |      |     |
| 882A               |   |                 | 14  |   |     |     |    |   |   |     |    |    |    |    |    |     |    |      | 14  |
| 885                | Personnel digital dosimeter             |                 | 4   |   |     |     |    |   |   |     |    |    |    | 10 |    |     |    | 14   |     |
| Ion Chambers       |   |                 |     |   |     |     |    |   |   |     |    |    |    |    |    |     |    |      | 0   |
| 440 RF/D           | Low Energy RF Shielded Survey Meter     |                 |     |   |     |     |    |   |   |     |    | 12 |    |    | 2  | 1   |    | 15   |     |
| 450                | Ion Chamber Survey Meter                | 1               | 160 |   |     | 97  | 5  |   |   |     |    |    |    |    |    |     |    | 263  |     |
| 450B, BE or E      | Ion Chamber Survey Meter                |                 | 30  |   |     |     |    |   |   | 29  |    |    |    |    |    |     |    | 59   |     |
| 450P               | Pressurized Ion Chamber Survey Meter    | 1               |     |   | 4   | 6   | 60 |   |   |     |    |    |    |    |    |     |    | 71   |     |
| 470A               | Panoramic Survey Meter                  |                 |     |   |     |     |    |   |   |     | 1  | 10 |    |    | 25 |     |    | 36   |     |
| 471 &471A          | Sensitive Wide Range Survey Meter       |                 |     |   | 25  |     |    |   |   |     |    |    |    |    | 40 |     |    | 65   |     |
| 471 RF             | Wide Range RF Shielded Survey Meter     |                 |     |   | 29  |     |    |   |   |     |    |    |    |    | 4  |     |    | 33   |     |
| CDV-715            | High Range ion Chamber                  |                 |     |   |     |     |    |   |   |     |    |    |    |    | 20 |     |    | 20   |     |
| CDV-720            | High Range ion Chamber                  |                 |     |   |     |     |    |   |   |     |    |    |    |    | 10 |     |    | 10   |     |
| Detectors & Probes |   |                 |     |   |     |     |    |   |   |     |    |    |    |    |    |     |    |      | 0   |
| RP-1               | Pancake Probe                           |                 |     |   |     |     |    |   |   |     |    |    |    |    |    |     |    |      | 0   |
| 489-1 I0C          | Pancake" GM Probe                       |                 |     |   |     |     |    |   |   |     |    |    |    |    |    |     |    |      | 0   |
| 425-200            | "Flashlight(" Probe                     |                 |     |   |     |     |    |   |   |     |    |    |    |    |    |     |    |      | 0   |
| 489-200            | Pancake" NaI Scintillation Probe        |                 |     |   |     |     |    |   |   |     |    |    |    |    |    |     |    |      | 0   |
| 700                | MICROSPEC-1                             |                 |     |   |     |     |    |   |   |     |    |    |    |    |    |     |    |      | 0   |
| 05-205             | Personal Rad Monitor                    |                 |     |   |     |     |    |   |   |     |    |    |    | 8  |    |     |    | 8    |     |
| 05-571             | Mini Monitor II GM Type Survey Meter    |                 |     |   |     |     |    |   |   |     |    |    |    |    |    |     |    |      | 0   |
| 05-572             | Mini Monitor Contamination Survey Meter |                 |     |   |     |     |    |   |   |     |    |    |    |    |    |     |    |      | 0   |
| 943-15             | Alpha Scintillation Detector            |                 |     |   |     |     |    |   |   |     |    |    |    |    |    |     |    |      | 0   |
| 943-25             | Beta Scintillation Detector             |                 |     |   |     |     |    |   |   |     |    |    |    |    |    |     |    |      | 0   |
| 943-35             | Gamma Scintillation Detector            |                 |     |   |     |     |    |   |   |     |    |    |    |    |    |     |    |      | 0   |
| 943-36             | Gamma Scintillation Detector            |                 |     |   |     |     |    |   |   |     |    |    |    |    |    |     |    |      | 0   |
| 943-37             | Gamma Scintillation Detector            |                 |     |   |     |     |    |   |   |     |    |    |    |    |    |     |    |      | 0   |
| 943-237A           | Gamma Scintillation Detector            |                 |     |   |     |     |    |   |   |     |    |    |    |    |    |     |    |      | 0   |
| VICTOREEN          | SUB TOTAL-----                          | 0               | 0   | 5 | 957 | 190 | 0  | 0 | 0 | 184 | 11 | 89 | 21 | 40 | 18 | 101 | 1  | 1617 |     |
| Manufacture:       |   |                 |     |   |     |     |    |   |   |     |    |    |    |    |    |     |    |      | 0   |

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|                                |  |                 |     |    |     |
|--------------------------------|--|-----------------|-----|----|-----|
| Detectors & Probes             |  |                 |     |    | 0   |
| 47-1501                        | MODEL 42-1 NEUTRON SCINTILLATOR              |                 |     |    | 0   |
| 47-1502                        | MODEL 42-2 NEUTRON SCINTILLATOR              |                 |     |    | 0   |
| 47-1414                        | MODEL 42-4 NEUTRON DETECTOR                  |                 |     |    | 0   |
| 47-1513                        | MODEL 42-9 NEUTRON DETECTOR                  |                 |     |    | 0   |
| 47-1516                        | MODEL 43-1 ALPHA SCINTILLATOR                |                 |     | 1  | 1   |
| 47-1517                        | MODEL 43-2 ALPHA SCINTILLATOR                |                 |     |    | 0   |
| 47-1520                        | MODEL 43-4 AIR PROP. ALPHA PROBE             |                 | 10  |    | 10  |
| 47-1521                        | MODEL 43-5 ALPHA SCINTILLATOR                | 15              |     | 6  | 21  |
| NA.                            | MODEL 43-10-1 ALPHA/BETA SCINTILLA           | 10              |     |    | 25  |
| 47-1530                        | MODEL 43-20 GAS PROP. DETECTOR               |                 | 20  |    | 30  |
| NA.                            | MODEL 43-37 GAS Proportional                 | 10              |     |    | 10  |
| 47-1169                        | MODEL 43-44 AIR PROP. ALPHA PROBE            |                 |     |    | 0   |
| 47-1441                        | MODEL 43-65 ALPHA SCINTILLATOR DETECTOR      |                 |     |    | 0   |
| 47-2005                        | MODEL 43-68 GAS PROPORTIONAL DETECTOR        |                 | 20  |    | 20  |
| NA.                            | MODEL 43-90 ALPHA RECTANGULAR SCINTILLATOR   |                 |     | 6  | 6   |
| NA.                            | MODEL 43-1 -1 ALPHA / BETA SCINTILLATOR      |                 |     |    | 0   |
| NA.                            | MODEL 43-2-2 ALPHA / BETA SCINTILLATOR       |                 |     |    | 0   |
|                                | Model Air prop. alpha probe                  |                 |     |    | 0   |
| NA.                            | MODEL 43-89 ALPHA / BETA RECT. SCINTILLATOR  |                 |     | 4  | 4   |
| LUDLUM MEASUREMENTS, INC-----  |  |                 |     |    | 0   |
| Model                          | Description                                  | Quantity IN USE |     |    | 0   |
|                                |  | (Approximate )  |     |    | 0   |
| Detectors & Probes (continued) |  |                 |     |    | 0   |
| 47-1536                        | MODEL 44-7 END WINDOW G-M DETECTOR           |                 |     | 2  | 2   |
| 47-1539                        | MODEL 44-9 PANCAKE G-M DETECTOR              |                 |     | 41 | 241 |
| 47-1531                        | MODEL 44-1 BETA SCINTILLATOR                 |                 |     |    | 0   |
| 47-1532                        | MODEL 44-2 GAMMA SCINTILLATOR                |                 |     |    | 0   |
| 47-1533                        | MODEL 44-3 GAMMA SCINTILLATOR                |                 |     | 4  | 4   |
| 47-1535                        | MODEL 44-6 STAINLESS STEEL G-M WALL PROBE    | 110             | 500 | 90 | 700 |
| NA.                            | MODEL 44-7 THIN WINDOW G-M DETECTOR          |                 |     |    | 0   |
| NA.                            | MODEL 44-9 PANCAKE G-M DETECTOR              |                 |     |    | 0   |
| 47-1540                        | MODEL 44-10 NaI(Tl) GAMMA SCINTILLATOR       |                 |     |    | 0   |
| 47-1541                        | MODEL 44-11 INTEGRAL LINE SCINTILLATOR       |                 |     |    | 0   |
| 47-1542                        | MODEL 44-12 INTEGRAL LINE WELL SCINTILLATOR  |                 |     |    | 0   |
| 47-1544                        | MODEL 44-14 Am-241 STABILIZED SCINTILLATOR   |                 |     |    | 0   |
| 47-1547                        | MODEL 44-17 Low energy GAMMA SCINTILLATOR    |                 |     |    | 0   |
| 47-1104                        | MODEL 44-20 INTEGRAL LINE SCINTILLATOR       |                 |     |    | 0   |
| 47-1560                        | MODEL 44-21 BETA/GAMMA SANDWICH PROBE        |                 |     |    | 0   |
| 47-1543                        | MODEL 44-22 LED STABILIZED SCINTILLATOR      |                 |     |    | 0   |
| 47-1510                        | MODEL 44-23 LED STABILIZED SCINTILLATOR      |                 |     |    | 0   |
| 47-1563                        | MODEL 44-33 Am-241 STABILIZED SCINTILLATOR   |                 |     |    | 0   |
| 47-1588                        | MODEL 44-38 ENERGY COMPENSATED G-M PROBE     |                 |     |    | 0   |
| 47-1538                        | MODEL 44-40 SHIELDED G-M PANCAKE PROBE       |                 |     | 5  | 5   |
| 47-1183                        | MODEL 44-58 G-M DETECTOR                     |                 |     |    | 0   |
| 47-1238                        | MODEL 44-62 GAMMA SCINTILLATOR               |                 |     |    | 0   |
| NA.                            | MODEL 44-92 100 CM XENON FILLED SCINTILLATOR |                 |     |    | 0   |
| NA.                            | MODEL 44-93 200 CM XENON FILLED SCINTILLATOR |                 |     |    | 0   |
| NA.                            | MODEL 44-98 BISMUTH GERMANATE SCINTILLATOR   |                 |     |    | 0   |
| 47-1717                        | MODEL 133-2 G-M DETECTOR                     |                 |     |    | 0   |



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| TBM-6A                         | Five Decade RATE METER WITH COMPENSATED DET.    |                 | 0  |
| TBM-23                         | TBM WITH GM PROBE ON 33 INCH WAND.              |                 | 0  |
| TBM-23A                        | LoW Background RATE METER WITH GM DET.          |                 | 0  |
| Tele-TBM-55                    | TelescopiNg PROBE WITH TBM RATE METER           |                 | 0  |
| PTS-6S                         | TritiuM Surface Monitor.                        |                 | 0  |
| PTS-7S                         | TritiuM Surface Monitor for flat surfaces,      |                 | 0  |
| Ion Chambers                   |   |                 | 0  |
| CPI-44                         | Integrating portable Survey meter.              |                 | 0  |
| CP-44                          | Portable Survey meter                           |                 | 0  |
| CP-44A                         | Portable Survey meter                           |                 | 0  |
| CP-5                           | Mark III Extended Range Portable Survey meter   |                 | 0  |
| CP-5A                          | Mark III extended Range Portable Survey meter   |                 | 0  |
| CP-6Q                          | Mark III Sensitive Extended Range Survey meter  |                 | 0  |
| PTG-5                          | Mark IV Portable Tritium monitor                |                 | 0  |
| PTS-6S                         | Portable Surface Tritium Contamination monitor  |                 | 0  |
| CP-TP-10K                      | Portable Survey Meter                           |                 | 0  |
| Detectors & Probes             |   |                 | 0  |
| P-6A                           | GM Probe  |                 | 0  |
| P-7                            | Beta-GAMMA                                      |                 | 0  |
| P-8                            | thin End WINDOW                                 |                 | 0  |
| P-10                           | Beta-GAMMA                                      |                 | 0  |
| P-11B                          | Alpha Beta PaNcake Probe                        | 10              | 10 |
| P-11A                          | Alpha Beta PaNcaKe PROBE                        |                 | 0  |
| TECHNICAL ASSOCIATES-----      |   |                 | 0  |
| Model                          | Description                                     | Quantity IN USE | 0  |
|                                |   | (Approximate )  | 0  |
| Detectors & Probes (continued) |   |                 | 0  |
| P-1210                         | low background Probe                            |                 | 0  |
| P-1212                         | low background 6eMM diaMeter                    |                 | 0  |
| P-1216                         | Energy compensated GM Probe                     |                 | 0  |
| P-13                           | Energy compensated GM Probe                     |                 | 0  |
| P-13A                          | Energy compensated GM Probe                     |                 | 0  |
| P-15                           | Alpha, Beta Pancake Probe                       |                 | 0  |
| P-17                           | Thin End WINDOW Probe,                          |                 | 0  |
| P-19                           | Beta Gamma Side Probe                           |                 | 0  |
| P-21                           | High Integrity Probe                            |                 | 0  |
| P-28                           | Alpha Beta Extended Pancake Probe               |                 | 0  |
| PAF-22                         | Scintillation Lucas Type Radon Cell.            |                 | 0  |
| PAS-8                          | Alpha scintillation Probe - 2" O.D.             |                 | 0  |
| PAS-9                          | Large Face Alpha scintillation Probe -5" O.D.   |                 | 0  |
| PA8S-47                        | Large Face Alpha and Beta/GAMMA Probe - 5" O.D. |                 | 0  |
| PGS-3                          | GAMMA SciNtillationN Probe                      |                 | 0  |
| PGS-3PL                        | 6GAMMA SciNtillationN Probe                     |                 | 0  |
| PGS-3I                         | GAMMA SciNtillationN Probe                      |                 | 0  |
| PGS-3IP                        | GAMMA SciNtillationN Probe                      |                 | 0  |
| PGS-3T                         | LoW ENERgy GAMMA SciNtillationN Probe           |                 | 0  |
| PGS-3L                         | GAMMA SciNtillationN Probe                      |                 | 0  |
| PGS-3LS                        | GAMMA scintillation Probe                       |                 | 0  |
| PGS-3LW                        | GAMMA SciNtillationN Probe                      |                 | 0  |

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|---|--|---------------------------------|-----|-----|-----|-----|----|-----|---|----|---|----|-----|-----|---|----|------|------|----|---|
| G2LE                                      |  | (2" diameter, low energy GAMMA) |     |     |     |     |    |     |   |    |   |    |     |     |   |    |      | 0    |    |   |
| GW2                                       |  | (2" x 2" NaI with well)         |     |     |     |     |    |     |   |    |   |    |     |     |   |    |      | 0    |    |   |
| BICRON                                    |  | CORP.-----                      |     |     |     |     |    |     |   |    |   |    |     |     |   |    |      | 0    |    |   |
| Model                                     | Description                            | Quantity IN USE                 |     |     |     |     |    |     |   |    |   |    |     |     |   |    |      | 0    |    |   |
|   |  | (Approximate )                  |     |     |     |     |    |     |   |    |   |    |     |     |   |    |      | 0    |    |   |
| Detectors & Probes (continued)            |  |                                 |     |     |     |     |    |     |   |    |   |    |     |     |   |    |      | 0    |    |   |
| G3  | (3" x 3" NaI)                          |                                 |     |     |     |     |    |     |   |    |   |    |     |     |   |    |      | 0    |    |   |
| G4  | (4" x 4" x 16" NaI)                    |                                 |     |     |     |     |    |     |   |    |   |    |     |     |   |    |      | 6    |    |   |
| G5  | (5" x .063" NaI FIDLER)                | 10                              |     |     |     |     |    |     |   |    |   |    |     | 50  |   |    | 60   |      |    |   |
| TN1                                       | (1" diameter, thermal neutron)         |                                 |     |     |     |     |    |     |   |    |   |    |     |     |   |    |      | 6    |    |   |
| FN1                                       | (1" diameter, fast neutron)            |                                 |     |     |     |     |    |     |   |    |   |    |     |     |   |    |      | 6    |    |   |
| BICRON                                    | CORP. SUB TOTAL-----                   | 0                               | 470 | 184 | 131 | 228 | 12 | 174 | 0 | 76 | 0 | 35 | 137 | 155 | 4 | 23 | 1130 | 2759 |    |   |
|   |  |                                 |     |     |     |     |    |     |   |    |   |    |     |     |   |    |      | 0    |    |   |
| Manufacture:                              |  |                                 |     |     |     |     |    |     |   |    |   |    |     |     |   |    |      | 0    |    |   |
| NRC                                       |  | INDUSTRIES -----                |     |     |     |     |    |     |   |    |   |    |     |     |   |    |      | 0    |    |   |
| Model                                     | Description                            | Quantity IN USE                 |     |     |     |     |    |     |   |    |   |    |     |     |   |    |      | 0    |    |   |
|   |  | (Approximate )                  |     |     |     |     |    |     |   |    |   |    |     |     |   |    |      | 0    |    |   |
| Integrated Survey Instruments / Detectors |  |                                 |     |     |     |     |    |     |   |    |   |    |     |     |   |    |      | 0    |    |   |
| ADM-300A                                  | Multi function survey inst.            |                                 |     |     |     |     |    |     |   |    |   |    |     |     |   |    |      | 5    | 5  |   |
| ADM-300X                                  | TELESCOPIC SURVEY METER                |                                 |     |     |     |     |    |     |   |    |   |    |     |     |   |    |      | 5    | 5  |   |
| ADM-300s                                  | HAND HELD survey inst.                 |                                 |     |     |     |     |    |     |   |    |   |    |     |     |   |    |      | 15   | 15 |   |
| ADM-300T                                  | HAND HELD TRITIUM MONITOR              |                                 |     |     |     |     |    |     |   |    |   |    |     |     |   |    |      |      | 0  |   |
| S M-200                                   | Ion chamber SURVEY METER               |                                 |     |     |     |     |    |     |   |    |   |    |     |     |   |    |      |      | 0  |   |
| S M-300                                   | COUNT RATE SURVEY METER                |                                 |     |     |     |     |    |     |   |    |   |    |     |     |   |    |      |      | 0  |   |
| S M-600                                   | COUNT RATE METER                       |                                 |     |     |     |     |    |     |   |    |   |    |     |     |   |    |      |      | 0  |   |
| RPM-50/MD-50                              | GAMMA RADIOMETER,                      |                                 |     |     |     |     |    |     |   |    |   |    |     |     |   |    |      |      | 0  |   |
| ASM-56                                    | ALPHA SURVEY MONITOR                   |                                 |     |     |     |     |    |     |   |    |   |    |     |     |   |    |      |      | 0  |   |
| NP-2                                      | NEUTRON MONITOR                        | 30                              |     |     |     |     | 2  |     |   |    |   |    |     |     | 3 | 50 | 85   |      |    |   |
| NG-2                                      | NEUTRON / GAMMA MONITOR                |                                 |     |     |     |     |    |     |   |    |   |    |     |     |   |    |      |      | 0  |   |
| Detectors & Probes                        |  |                                 |     |     |     |     |    |     |   |    |   |    |     |     |   |    |      | 0    |    |   |
| AP-100                                    | ALPHA PROBE                            |                                 |     |     |     |     |    |     |   |    |   |    |     |     |   |    |      | 15   | 15 |   |
| BGP-100                                   | GAMMA PROBE                            |                                 |     |     |     |     |    |     |   |    |   |    |     |     |   |    |      |      | 5  | 5 |
| NP-100                                    | NEUTRON PROBE                          |                                 |     |     |     |     |    |     |   |    |   |    |     |     |   |    |      |      |    | 0 |
| XP-100                                    | XRAY PROBE                             |                                 |     |     |     |     |    |     |   |    |   |    |     |     |   |    |      |      |    | 0 |
| BP-100                                    | BETA PROBE                             |                                 |     |     |     |     |    |     |   |    |   |    |     |     |   |    |      |      | 5  | 5 |
|   |  |                                 |     |     |     |     |    |     |   |    |   |    |     |     |   |    |      | 0    |    |   |
| Ion Chamber                               |  |                                 |     |     |     |     |    |     |   |    |   |    |     |     |   |    |      |      | 0  |   |
| SM-400                                    | Ion chamber WITH RATE METER LOW ENERGY |                                 |     | 79  |     |     |    |     |   |    |   |    |     |     |   |    | 79   |      |    |   |
| CP-2A                                     | Ion chamber WITH RATE METER            |                                 |     |     |     |     |    |     |   |    |   |    |     |     |   |    |      |      | 0  |   |
| CP-5A                                     | Ion chamber WITH RATE METER            |                                 |     |     |     |     |    |     |   |    |   |    |     |     |   |    |      |      | 0  |   |
| CP-10A                                    | Ion chamber WITH RATE METER            |                                 |     |     |     |     |    |     |   |    |   |    |     |     |   |    |      |      | 0  |   |
| CP-1000A                                  | Ion chamber WITH RATE METER            |                                 |     |     |     |     |    |     |   |    |   |    |     |     |   |    |      |      | 0  |   |
| CP-500                                    | Ion chamber WITH RATE METER            |                                 |     |     |     |     |    |     |   |    |   |    |     |     |   |    |      |      | 0  |   |
| GSM-27T                                   | BETA - GAMMA RADIOMETER                |                                 |     |     |     |     |    |     |   |    |   |    |     |     |   |    |      |      | 0  |   |
| NRC INDUSTRIES. SUB TOTAL-----            |  | 0                               | 30  | 0   | 79  | 0   | 2  | 0   | 0 | 0  | 0 | 0  | 0   | 30  | 0 | 23 | 50   | 214  |    |   |
|   |  |                                 |     |     |     |     |    |     |   |    |   |    |     |     |   |    |      | 0    |    |   |
| OTHER                                     |  | MANUFACTURES -----              |     |     |     |     |    |     |   |    |   |    |     |     |   |    |      | 0    |    |   |
|   |  |                                 |     |     |     |     |    |     |   |    |   |    |     |     |   |    |      | 0    |    |   |

JC-118903 App A

|   |                              |                 |   |    |   |   |   |    |     |   |     |    |   |     |     |    |   |   |     |
|---|------------------------------|-----------------|---|----|---|---|---|----|-----|---|-----|----|---|-----|-----|----|---|---|-----|
| Name of manufacture                       |                              |                 |   |    |   |   |   |    |     |   |     |    |   |     |     |    |   |   | 0   |
| Model                                     | Description                  | Quantity IN USE |   |    |   |   |   |    |     |   |     |    |   |     |     |    |   |   | 0   |
| (Approximate )                            |                              |                 |   |    |   |   |   |    |     |   |     |    |   |     |     |    |   |   | 0   |
| Integrated Survey Instruments / Detectors |                              |                 |   |    |   |   |   |    |     |   |     |    |   |     |     |    |   |   | 0   |
| XETEX                                     |                              |                 |   |    |   |   |   |    |     |   |     |    |   |     |     |    |   |   | 0   |
|   | XETEX EXTENDABLE/ HIGH RANGE |                 |   | 10 |   |   |   |    |     |   | 1   |    |   |     |     |    |   |   | 11  |
|   | XETEX 305B                   |                 |   |    |   |   |   |    |     |   | 4   |    |   |     |     |    |   |   | 4   |
|   | Model 330A telescan          |                 |   |    |   |   |   |    |     |   |     |    |   |     |     |    | 9 |   | 9   |
|   | XETEX 409A                   |                 |   |    |   |   |   |    |     |   | 6   |    |   |     |     |    |   |   | 6   |
|   | XETEX 415A                   |                 |   |    |   |   |   |    |     |   | 125 |    |   | 225 |     |    |   |   | 350 |
|   | XETEX 415B                   |                 |   |    |   |   |   |    |     |   | 22  |    |   |     |     |    |   |   | 22  |
|   | XETEX416A                    |                 |   |    |   |   |   |    |     |   | 40  |    |   |     |     |    |   |   | 40  |
|   | XETEX 418R                   |                 |   |    |   |   |   |    |     |   | 5   |    |   |     |     |    |   |   | 5   |
|   | 440A                         |                 |   |    |   |   |   |    |     |   | 99  |    |   |     |     |    |   |   | 99  |
|   | XETEX BENCH TOP              |                 |   | 15 |   |   |   |    |     |   |     |    |   |     |     |    |   |   | 15  |
| XETEX. SUB                                | TOTAL-----                   | 0               | 0 | 25 | 0 | 0 | 0 | 0  | 0   | 0 | 302 | 0  | 0 | 0   | 225 | 0  | 0 | 9 | 561 |
| Health Physics Instr.                     |                              |                 |   |    |   |   |   |    |     |   |     |    |   |     |     |    |   |   | 0   |
|   | HPI 1010                     |                 |   |    |   |   |   |    |     |   |     | 4  |   |     |     |    |   |   | 4   |
|   | HPI 1072                     |                 |   |    |   |   |   |    |     |   |     | 9  |   |     |     |    |   |   | 9   |
|   | HPI 1075                     |                 |   |    |   |   |   |    |     |   |     | 2  |   |     |     |    |   |   | 2   |
| Health Physics Instr. Totals              |                              | 0               | 0 | 0  | 0 | 0 | 0 | 0  | 0   | 0 | 0   | 15 | 0 | 0   | 0   | 0  | 0 | 0 | 15  |
| Dosimeter Corp.                           |                              |                 |   |    |   |   |   |    |     |   |     |    |   |     |     |    |   |   | 0   |
|   | SRPD's                       |                 |   |    |   |   |   | 74 | 145 |   |     |    |   |     |     |    |   |   | 219 |
|   | FAG Extender                 |                 |   |    |   |   |   |    |     |   |     |    |   |     |     |    | 2 |   | 2   |
|   | MCR II                       |                 |   |    |   |   |   |    |     |   | 3   |    |   |     |     |    |   |   | 3   |
|   | SUPERDAD                     |                 |   |    |   |   |   |    |     |   | 3   |    |   |     |     |    |   |   | 3   |
|   | MODEL 1888B                  |                 |   |    |   |   |   |    |     |   |     | 5  |   |     |     |    |   |   | 5   |
| Dosimeter Corp                            | SUB TOTAL-----               | 0               | 0 | 0  | 0 | 0 | 0 | 74 | 145 | 6 | 5   | 0  | 0 | 0   | 0   | 0  | 0 | 2 | 232 |
| TSI Inc.                                  |                              |                 |   |    |   |   |   |    |     |   |     |    |   |     |     |    |   |   | 0   |
|   | TSI 1650                     |                 |   |    |   |   |   |    |     |   |     | 3  |   |     |     |    |   |   | 3   |
|   | TSI 8355                     |                 |   |    |   |   |   |    |     |   |     | 5  |   |     |     |    |   |   | 5   |
| TSI Inc. Totals                           | -----                        | 0               | 0 | 0  | 0 | 0 | 0 | 0  | 0   | 0 | 0   | 8  | 0 | 0   | 0   | 0  | 0 | 0 | 8   |
| TSA                                       |                              |                 |   |    |   |   |   |    |     |   |     |    |   |     |     |    |   |   | 0   |
|   | MMD-4Gamma Scint.            |                 |   |    |   |   |   |    |     |   |     |    |   | 35  |     |    |   |   | 35  |
| FEMTO-TECH                                |                              |                 |   |    |   |   |   |    |     |   |     |    |   |     |     |    |   |   | 0   |
|   | PTM-1 Tritium monitors       |                 |   |    |   |   |   |    |     |   |     |    |   |     | 5   |    |   |   | 5   |
| OVERHOFF                                  |                              |                 |   |    |   |   |   |    |     |   |     |    |   |     |     |    |   |   | 0   |
|   | 394C                         |                 |   |    |   |   |   |    |     |   | 34  |    |   |     | 56  |    |   |   | 90  |
|   | 397 Tritium mon.             |                 |   | 5  |   |   |   |    |     |   |     |    |   |     |     |    |   |   | 5   |
| OVERHOFF Totals                           | -----                        | 0               | 0 | 0  | 5 | 0 | 0 | 0  | 0   | 0 | 34  | 0  | 0 | 0   | 0   | 56 | 0 | 0 | 95  |
| RIKE                                      |                              |                 |   |    |   |   |   |    |     |   |     |    |   |     |     |    |   |   | 0   |
|   | PAD201                       |                 |   |    |   |   |   |    |     |   | 18  |    |   |     |     |    |   |   | 18  |
| National Nuclea HM-3                      |                              |                 |   |    |   |   |   |    |     |   |     |    |   |     |     |    |   |   | 0   |
|   |                              |                 |   |    |   |   |   |    |     |   |     | 15 |   |     |     |    |   |   | 15  |
| Johnston Laboratories                     |                              |                 |   |    |   |   |   |    |     |   |     |    |   |     |     |    |   |   | 0   |
| Gs-M-10                                   | Alpha count rate             |                 |   |    |   |   |   |    |     |   |     |    |   |     | 10  |    |   |   | 10  |
| Gs-M-5                                    | Alpha count rate             |                 |   |    |   |   |   |    |     |   |     |    |   |     | 25  |    |   |   | 25  |



## Appendix B

### List of Instrument Models at DOE Sites

**Table 1. DOE sites that have instrument models with over 99 units in use.**

| <b>Manufacturer</b>              | <b>Model</b>                 | <b>Number<br/>in use</b> |
|----------------------------------|------------------------------|--------------------------|
| <b>EBERLINE</b>                  |                              |                          |
| ASP-1                            | Analog Smart Portable        | 185                      |
| E-120/E-120E                     | Beta-Gamma Count Rate Meter  | 400                      |
| E-140                            | Beta-Gamma Count Rate Meter  | 602                      |
| ESP-1                            | Eberline Smart Portable      | 260                      |
| ESP-2                            | Eberline Smart Portable      | 371                      |
| SRM-200                          | Smart Radiation Monitor      | 131                      |
| RM12 w/43-5                      | Bench-top Rate Meter w/Det.  | 220                      |
| RM12 w/44-9                      | Bench-top Rate Meter w/Det.  | 584                      |
| RM14                             | Gamma                        | 150                      |
| 6112B/6150                       | Teletectors                  | 146                      |
| ATD                              |                              |                          |
| <b>Ion Chambers</b>              |                              |                          |
| PIC-6A or B                      | Portable Ion Chamber         | 440                      |
| RO-2/2A/20                       | Ion Chamber (Juno Type)      | 1411                     |
| RO-3C/3D                         | Ion Chamber (Cutie Pie Type) | 767                      |
| RO-7                             | Ion Chamber (High Range )    | 124                      |
| <b>Neutron</b>                   |                              |                          |
| ASP-1/NRD                        | Portable Neutron Rem Counter | 120                      |
| PNR-4/NRD                        | Neutron Rem Counter          | 99                       |
| <b>Detectors and Probes</b>      |                              |                          |
| AC-3                             | Alpha Scintillation Probe    | 450                      |
| HP-190A                          | Hand Probe                   | 100                      |
| HP-210T/AL/L                     | Hand Probe                   | 208                      |
| HP-260                           | GM Hand Probe                | 1875                     |
| HP-270/90                        | Hand Probe                   | 786                      |
| NRD                              | Neutron Detector             | 215                      |
| <b>VICTOREEN</b>                 |                              |                          |
| 496                              | Survey Meter                 | 957                      |
| 450                              | Ion Chamber Survey Meter     | 263                      |
| <b>LUDLUM MEASUREMENTS, INC.</b> |                              |                          |
| <b>Rate meters</b>               |                              |                          |
| 48-1602                          | Model 2 Survey Meter         | 165                      |
| 48-1605                          | Model 3 Survey Meter         | 1059                     |
| 48-1609                          | Model 12 Count Rate Meter    | 1701                     |
|                                  | Model 101                    | 126                      |

|   |  |              |
|---|--|--------------|
| <b>Integrated Survey Instruments/</b>   |  |              |
| <b>Detectors</b>                        |  |              |
| <b>48-1611</b>                          | <b>Model 14C w/Internal Gamma Det.</b>           | <b>323</b>   |
| <b>48-1615</b>                          | <b>Model 19 w/Nal Det.</b>                       | <b>108</b>   |
|   | <b>Model 12 w-44-9 Det.</b>                      | <b>148</b>   |
| <b>Detectors and Probes (Cont'd)</b>    |  |              |
| <b>47-1539</b>                          | <b>Model 44-9 Pancake G-M Detector</b>           | <b>241</b>   |
| <b>47-1535</b>                          | <b>Model 44-6 Stainless Steel G-M Wall Probe</b> | <b>700</b>   |
|   | <b>Model 139 w/43-22 Air Prop. Alpha</b>         | <b>443</b>   |
|   | <b>Model FM-177 Alpha</b>                        | <b>114</b>   |
|   | <b>Model FM-177 Beta</b>                         | <b>145</b>   |
| <b>Scalar Rate Meters and Analyzers</b> |  |              |
| <b>48-2065</b>                          | <b>Model 2221 Portable Scalar/Rate Meter</b>     | <b>102</b>   |
| <b>48-1648</b>                          | <b>Model 2000 Scalar/Rate Meter</b>              | <b>123</b>   |
| <b>TECHNICAL ASSOCIATES</b>             |  |              |
| <b>Integrated Survey Instruments/</b>   |  |              |
| <b>Detectors</b>                        |  |              |
|   |  | <b>0</b>     |
| <b>TBM-3S</b>                           | <b>RuggedIZED TBM-3</b>                          | <b>126</b>   |
| <b>BICRON CORP.</b>                     |  |              |
| <b>Analyst</b>                          | <b>Portable Analyzer/Rate Meter</b>              | <b>132</b>   |
| <b>Surveyor</b>                         | <b>GM Survey Rate Meter</b>                      | <b>165</b>   |
| <b>2000</b>                             |  |              |
| <b>Surveyor M</b>                       | <b>GM Count Rate Meter W/PGM</b>                 | <b>135</b>   |
| <b>Surveyor X</b>                       | <b>GM Survey Rate Meter</b>                      | <b>1080</b>  |
| <b>Other</b>                            |  |              |
| <b>Micro Rem</b>                        |  |              |
| <b>Micro</b>                            | <b>Tissue-Equivalent Survey Meters</b>           | <b>210</b>   |
| <b>Sievert</b>                          |  |              |
| <b>Detector and Probes</b>              |  |              |
| <b>PGM</b>                              | <b>Simple GM Tube</b>                            | <b>100</b>   |
| <b>A50</b>                              | <b>(50 cm<sup>2</sup> alpha)</b>                 | <b>100</b>   |
| <b>A100</b>                             | <b>(100 m<sup>2</sup> alpha)</b>                 | <b>150</b>   |
| <b>OTHER MANUFACTURERS</b>              |  |              |
| <b>XETEX</b>                            |  |              |
|   | <b>XETEX 415A</b>                                | <b>350</b>   |
|   | <b>400A</b>                                      | <b>99</b>    |
| <b>Dosimeter Corp.</b>                  |  |              |
|   | <b>SRPDs</b>                                     | <b>219</b>   |
| <b>Scintrex</b>                         | <b>Tritium in Air Monitor</b>                    | <b>108</b>   |
| <b>209X</b>                             |  |              |
| <b>Bethold</b>                          | <b>LB 1043 AS</b>                                | <b>210</b>   |
| <b>In-House Design</b>                  |  |              |
| <b>LLNL</b>                             | <b>LE751854</b>                                  | <b>366</b>   |
| <b>Hanford (PNL)</b>                    | <b>Alpha scintillation probes</b>                | <b>852</b>   |
| <b>Hanford (PNL)</b>                    | <b>Pancake GM Hand Probe</b>                     | <b>862</b>   |
|   | <b>Total</b>                                     | <b>21626</b> |





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